

Features

- Transient protection for high-speed data lines
 IEC61000-4-2 (ESD) $\pm 14\text{kV}$ (Air)
 $\pm 10\text{kV}$ (Contact)
 IEC61000-4-5 (Lightning) 4.5A (8/20 μs)
- Small package saves board space
- Protects one I/O line (bidirectional)
- Low capacitance: $0.22\text{pF}@0\text{V}$ (Typical) (I/O-I/O)
- Low leakage current: 50nA @ V_{RWM} (Maximum)
- Low clamping voltage
- Each I/O pin can withstand over 1000 ESD strikes for $\pm 10\text{kV}$ contact discharge

Description

TT0241SA-FxX is an ultra-low capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of 0.22pF only, it is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events.

The TT0241SA-FxX comes in a RoHS compliant and Halogen Free $0.6\text{mm} \times 0.3\text{mm} \times 0.27\text{mm}$ DFN0603-2L package.

Applications

- Portable applications
- Communication systems
- Computers and peripherals
- High speed data lines:
 ➢ USB 3.X and USB 4.0

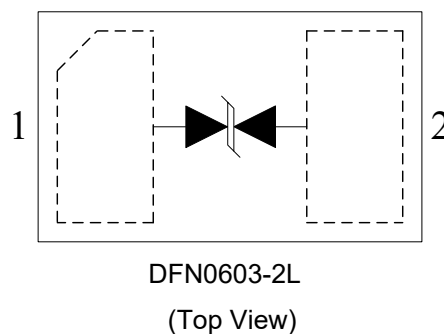
Mechanical Characteristics

- Package: DFN0603-2L
- Marking: Part number
- Packaging: Tape and Reel
- ROHS compliant

Circuit Diagram



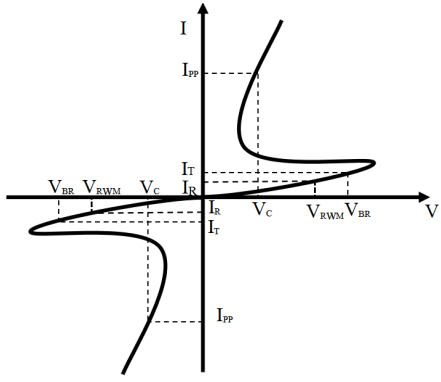
Pin Configuration



Absolute Maximum Rating

Symbol	Parameter	Value	Units
I_{PP}	Peak Pulse Current (8/20 μ s)	4.5	A
P_{PK}	Peak Pulse Power (8/20 μ s)	20	W
V_{ESD}	ESD per IEC61000-4-2 (Air) ESD per IEC61000-4-2 (Contact)	± 14 ± 10	kV
T_{OPT}	Operating Temperature	-55/+125	°C
T_{STG}	Storage Temperature	-55/+150	°C

Electrical Characteristics (T = 25°C)

Symbol	Parameter	Diagram
V_{RWM}	Nominal Reverse Working Voltage	
I_R	Reverse Leakage Current @ V_{RWM}	
V_{BR}	Reverse Breakdown Voltage @ I_T	
I_T	Test Current for Reverse Breakdown	
V_C	Clamping Voltage @ I_{PP}	
I_{PP}	Maximum Peak Pulse Current	
C_{ESD}	Parasitic Capacitance	
R_{dyn}	Dynamic Resistance	
α_{IL}	Insertion Loss	

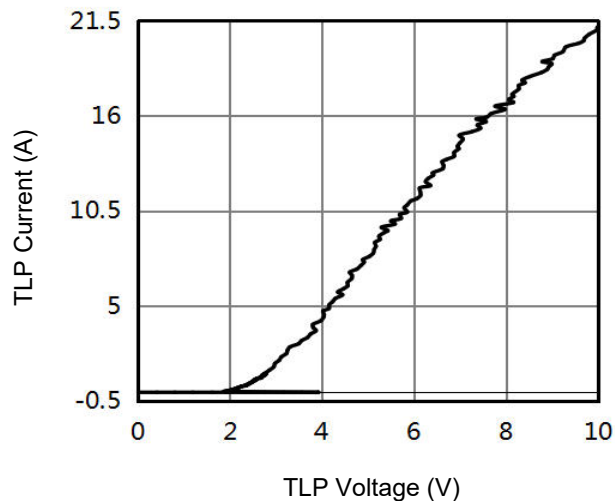
Symbol	Test Condition	Minimum	Typical	Maximum	Units
V_{RWM}				2.0	V
I_R	$V_{RWM} = 1.5V, T = 25^\circ C$		1	10	nA
	$V_{RWM} = 2.0V, T = 25^\circ C$		10	50	nA
V_{BR}	$I_T = 0.01mA$	2.5	3.2		V
V_C	$I_{PP} = 4.5A, t_p = 8/20\mu s$		4.5	7.0	V
V_C	$I_{PP} = 8.0A, t_p = 100ns^{(1)}$		5.5		V
	$I_{PP} = 16.0A, t_p = 100ns^{(1)}$		8.0		V
R_{dyn}	$I_{PP} = 12.0A, t_p = 100ns^{(1)}$		0.32		Ω

Notes: (1) Measurements performed using a 100ns Transmission Line Pulse (TLP) system.

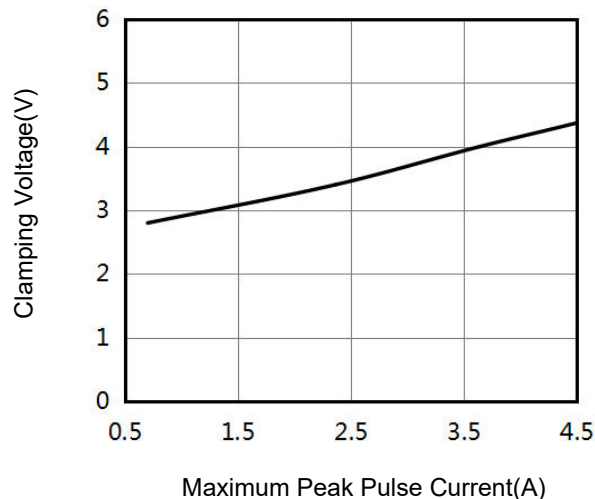
Symbol	Test Condition	Minimum	Typical	Maximum	Units
C_{ESD}	$V_R = 0V, f = 1MHz$		0.22		pF
	$V_R = 0V, f = 5GHz$		0.19		pF
α_{IL}	$f = 5GHz$		-0.15		dB
	$f = 10GHz$		-0.98		dB

Typical Performance Characteristics

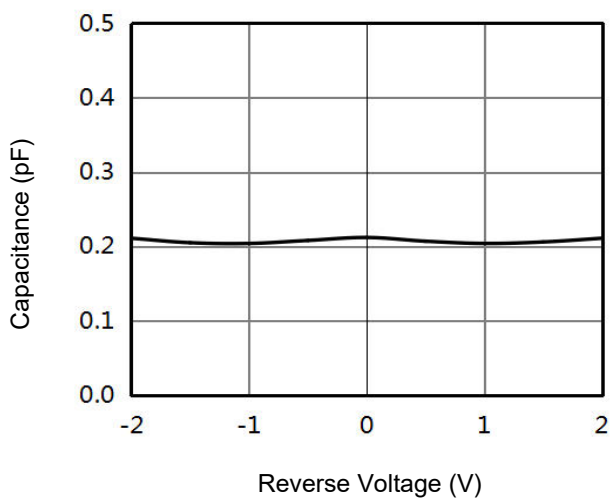
TLP Measurement of I/O to I/O



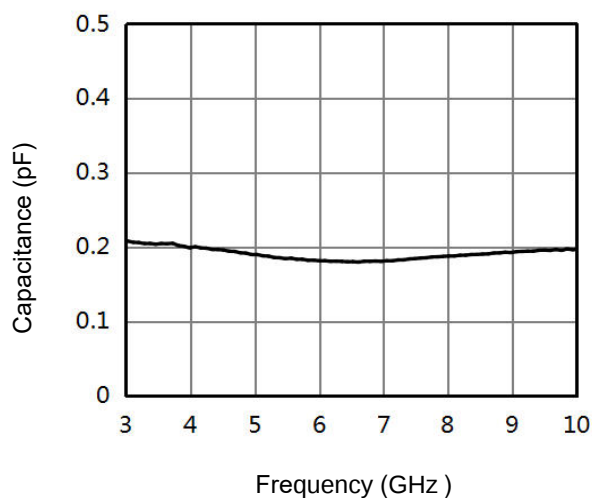
8/20us Current of I/O to I/O



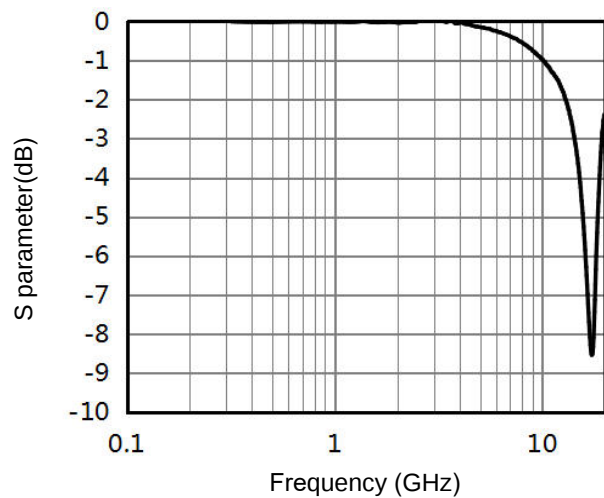
Capacitance vs Reverse Voltage of I/O to I/O



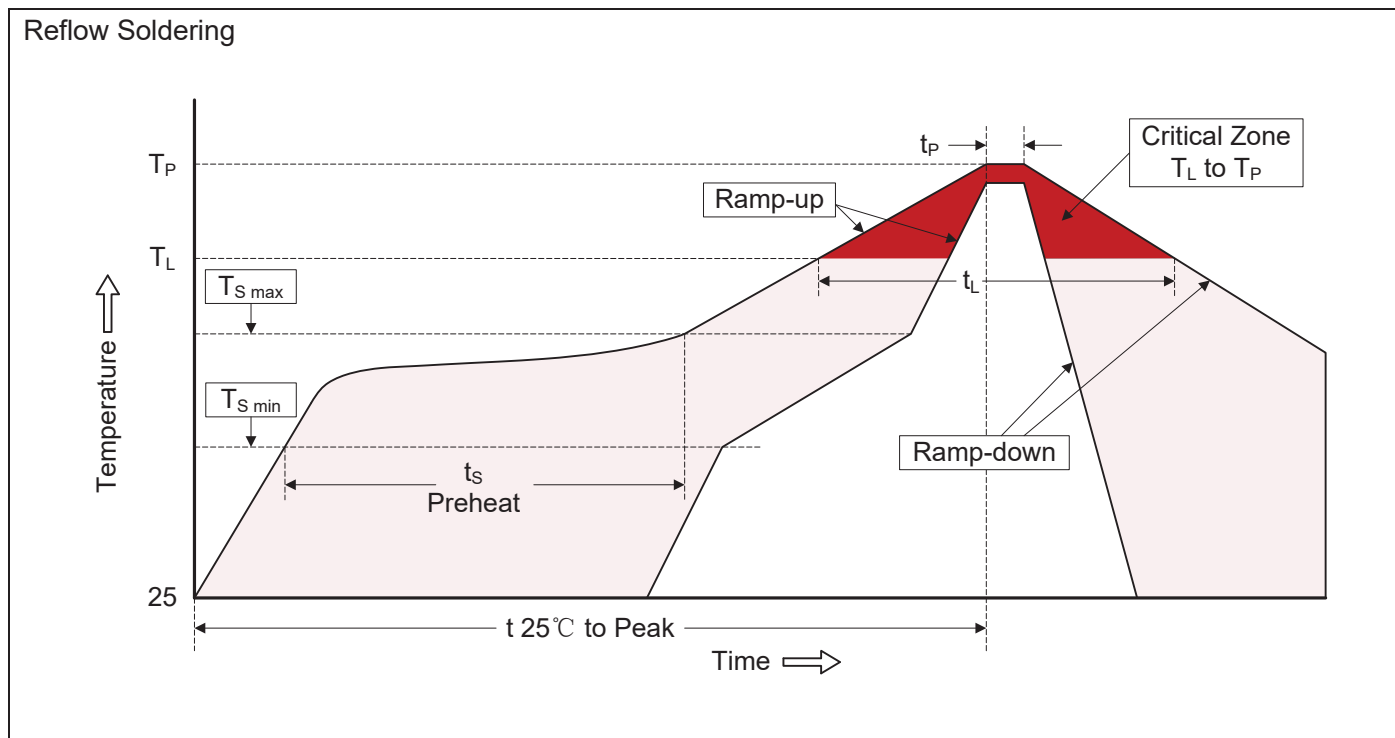
Capacitance vs Frequency of I/O to I/O



Insertion loss



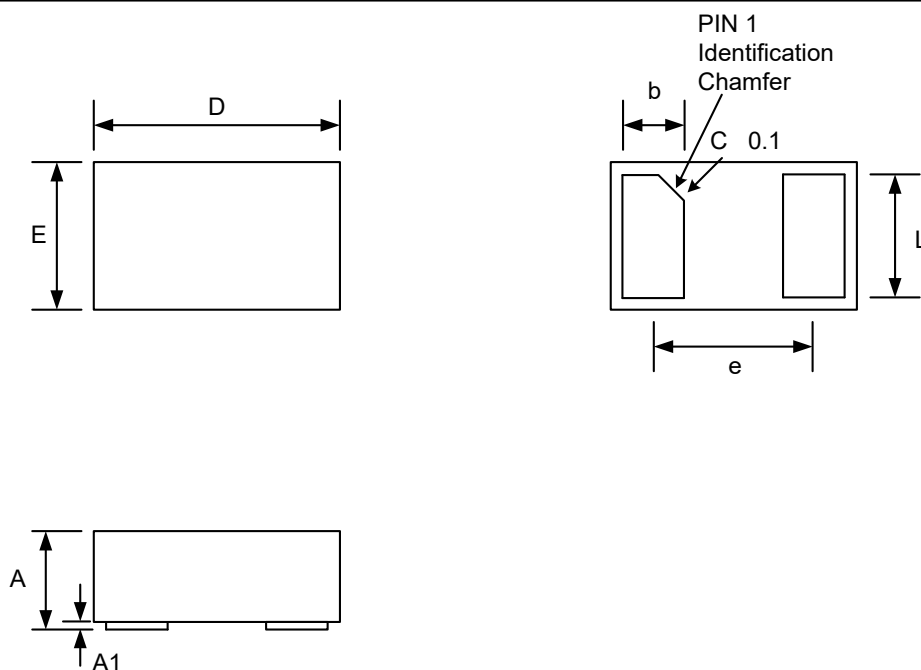
Recommended Soldering Conditions



Recommended Conditions	
Profile Feature	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	3°C/second max.
Preheat -Temperature Min ($T_{S\ min}$) -Temperature Max ($T_{S\ max}$) -Time (min to max) (t_s)	150°C 200°C 60-180 seconds
$T_{S\ max}$ to T_L -Ramp-up Rate	3°C/second max.
Time maintained above: -Temperature (T_L) -Time (t_L)	217°C 60-150 seconds
Peak Temperature (T_P)	260°C
Time within 5°C of actual Peak Temperature (t_P)	20-40 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

Package Outline

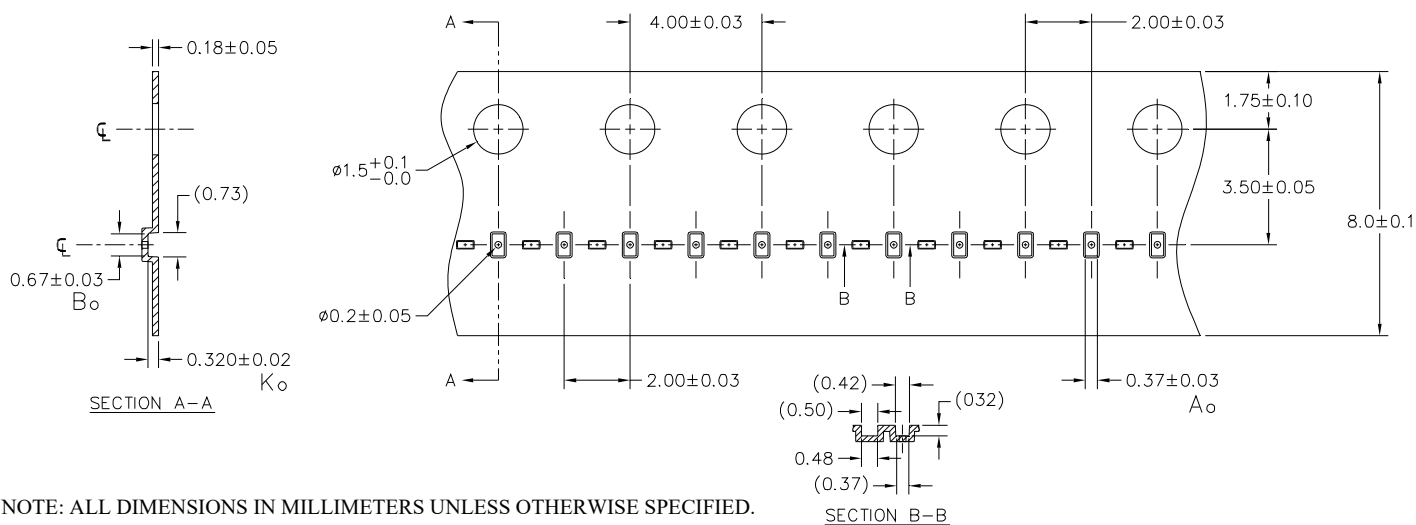
- ❑ DFN0603-2L package
- ❑ 2 leads, very small package
- ❑ MSL-1



Package Dimensions (Controlling dimensions are in millimeters)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Minimum	Maximum	Minimum	Maximum
A	0.270	0.330	0.011	0.013
A1	0.000	0.050	0.000	0.002
D	0.600	0.640	0.023	0.025
E	0.300	0.340	0.011	0.013
b	0.115	0.175	0.005	0.007
e	0.400 BSC		0.016 BSC	
L	0.215	0.275	0.008	0.011

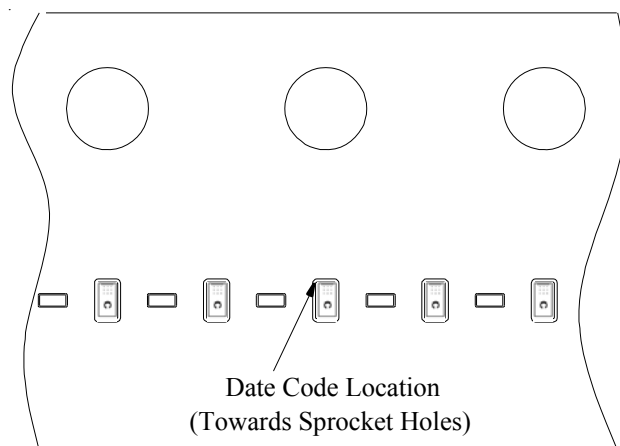
Carries Tape Specification



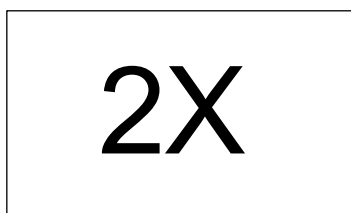
Device Orientation in Tape

A0	B0	K0
0.37 ± 0.03	0.67 ± 0.03	0.32 ± 0.02 mm

Note: All dimensions in mm unless otherwise specified



Marking Codes



Note:

- (1) "2" is part number.
- (2) "X" is the internal code.

Ordering Information

Part Number	Working Voltage	Quantity Per Reel	Reel Size
TT0241SA-FxX	2.0V	10,000	7 Inch